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A model of efficiency for copper mines

Kennecott's Bingham Canyon copper operation celebrated its rebirth in September 1988 with the completion of a $400 million modernization. Today, Kennecott is once again competing in the world copper market, with the most modern copper mining and concentrating facility in the world.

After eight years of planning and construction, Kennecott has become a model of efficiency for copper mines around the globe.

Bingham Canyon contains a large supply of high quality ore reserves, even though it has already produced more than 12 million tons of refined copper in more than 80 years of operation. Since the pit began operation in the early 1900s, more than 5 billion tons of material have been removed, turning what once was a mountain into the world's largest man-made excavation.

The planning for the modernization of Bingham Canyon began in 1980. Kennecott's team looked at dozens of difference modernization plans. In all, 128 different alternatives were considered before the plans to turn Bingham Canyon into a highly efficient, ultramodern copper producer were finalized.

Construction began in the fall of 1986. By the time it was completed in 1988, 4 million man-hours had been devoted to the planning and construction of the modernized facilities at Kennecott's Bingham Canyon mine.

A large, continuous transport system has replaced multiple haulage units. Fewer but larger pieces of equipment have replaced many crushing, grinding and flotation units. The result is less maintenance, fewer employees and improved metal recoveries.

Kennecott's old ore handling system consisted of hauling ore by railcars 17 miles from the mine to the concentrator. This system has been replaced by a new in-pit crusher and ore conveyor system that eliminates shovel reloading of ore into trains, the three rail car dumpers and three gyratory crushers formerly at the concentrators.

Now, ore handling consists of 30-cubic yard electric shovels loading the ore into 190-ton trucks, which haul the ore directly to the 60-inch by 109-inch in-pit gyratory crusher. Here the ore is crushed to less than 10-inch size, and falls onto a 72-inch wide conveyor. This conveyor moves up to 10,000 tons of ore per hours 3.2 miles through an old railroad tunnel, and then north of Copperton two miles to the new concentrator.

As the copper ore arrives at the concentrator after a trip of less than 30 minutes, it is dumped into a covered A-frame stockpile that can hold 350,000 tons, enough ore to supply the concentrator for five days.

A state-of-the-art computer system in the concentrator building controls ore delivery, grinding, flotation and concentrate delivery.

Three conveyor lines carry the ore from the bottom of the stockpile into three 34-foot-diameter semi-autogenous (SAG) grinding mills. These mills are the largest of their kind in the world. These SAG mills grind the ore to quarter-inch size and then send it to six 18-foot diameter ball mills where it is ground to the consistency of face powder. These nine large mills replaced over 200 smaller, outdated mills and crushers.

After the ore leaves Kennecott's gigantic grinding plant, it enters the new flotation building that holds large flotation cells, including 33 of the largest every made.

In the flotation cells, the copper slurry is agitated to a bubbly froth. Particles containing metal stick to the bubbles, which float off the top, are thickened and become a concentrate that contains 28 percent copper. During flotation, other precious metals including gold, silver and molybdenum are also separated from the waste rock.

The 28 percent copper concentrate is then pumped 17 miles through a 6-inch diameter steel pipeline to a new filtration plant at the Garfield smelter. The modernized process flow was completed with a 13-mile tailings pipeline from the new Copperton plant to the existing tailings pond and a new return line for process water.

Kennecott's 2,100 employees produce more than 200,000 tons of refined copper per year, 300,000 ounces of gold, 2.3 million ounces of silver and 12 million pounds of molybdenum.

The modernization of Bingham Canyon has improved the productivity by 350 percent, while production costs, measured in constant dollars, have been reduced by 75 percent. The modernization will allow Kennecott to continue operation of the Bingham Canyon mine for at least another 30 years.

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